UNITED STATES ENVIRONMENTAL PROTECTION AGENCY 0211837

DATE: JUL 22 1980

SUBJECT: Particulate and Lead Stack Test at ASARCO Lead Smelter, East Helena, Montana on September 20-29, 1979



FROM: Michael Davenport 8MO MD.
Environmental Engineer

TO: Files



Address:

ASARCO, Inc.
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Attendees:

ASARCO

P. A. DeSantis, Plant Manager
Robert Hearst, Plant Superintendent
Jim Sieverson, Industrial Hygenist
Charles Count, Fume Recovery Engineer
ASARCO Central Engineering

Pacific Environmental Services (PES)

Robert Gordon, Project Manager
Gary Quinn, Stack Tester and two other stack testers

Certified Testing Laboratories (CTL)

Stuart Salot, Industrial Hygenist
and a two person test crew

U.S. Environmental Protection Agency, Region VIII

Martin Byrne, Chemist
Thomas Harris, Task Manager for Test
Michael Davenport, Environmental Engineer
Kenneth Alkema, Air, Pesticides and Solid Waste Coordinator
Dick Montgomery, Environmental Engineer

Purpose:

This source test was performed to obtain lead stack emission data for the ASARCO, East Helena Plant. Also an inspection was made to evaluate compliance with regulations for control of particulate emissions and visible emissions. These regulations are the Montana Air Quality Regulations (AQB).

Section 16-2.14(1)-S1430 Particulate Matter, Industrial Processes
Section 16-2.14(1)-S1440 Particulate Matter, Airborne
Section 16-2.14(1)-S1460 Visible Air Contaminants, Restrictions.

Background:

The U. S. Environmental Protection Agency promulgated a National Ambient Air Quality Standard (NAAQS) for lead on October 5, 1978. The NAAQS is 1.5 micrograms of lead per cubic meter of air averaged over a calendar quarter. The lead regulations requires that a State Implementation Plan (SIP) be prepared for areas in the vicinity of primary lead and primary copper smelters. To prepare the SIP for the ASARCO, East Helena plant, an accurate point source emission inventory for lead is needed and stack tests were conducted on September 20-29, 1979 to obtain the lead stack emission data.

General Process Description(1):

The ASARCO lead smelter at East Helena, Montana is a custom smelter processing approximately 300,000 tons/yr of both domestic and foreign ore concentrates and producing approximately 60,000 ounces of gold, 18 million ounces of silver, 62,000 tons of lead and 8,500 tons of copper in by-products. All recovered metals are not for final sale but are shipped to other plants for further processing. Figure 1 is an overall diagram of the East Helena plant.

The concentrates are transported by rail to the plant, are mixed and nodulized to form pellets, and are fed to a sinter machine. Sintering oxidizes the ore concentrate and reduces the sulfur content while producing a porous agglomerated mass called sinter. The sinter is fed to a blast furnace for reducing and melting the charge into molten slag and matte (furnace lead). A mixture of furnace lead and slag is continuously tapped from the blast furnace. This mixture is separated by a confidential process. The furnace lead goes to the dross plant and is poured into kettles. In the kettles, dross (copper compound) is separated from the lead. The dross is melted in the dross reverberating furnace and the lead is poured into 10 ton molds for later shipment to a lead refinery. The molten dross in the reverberatory furnace is periodically tapped into matte, speiss, and additional lead, as the products. Matte is a mixture of iron and copper sulfides and speiss is a mixture of copper arsenides and antimonides. (Figure 2 shows a schematic of the plant process.) For a more thorough description of the process, one should see the April 16, 1979 trip report conducted by Michael Davenport, EPA Montana Office and Harry Keltz, Montana AQB.

Discussion:

On September 21, 1979 through September 29, 1979, opacity and lead tests were conducted on the main stack flue, zinc stack flue, and the three blast baghouse stacks. An additional test was scheduled for the dross ventilation baghouse stack but was cancelled. Tables I-V summarizes the test results.

The lead tests were conducted using EPA's "Procedure for Determining the Inorganic Lead Emissions from Stationary Sources." Particulate

(1)ASARCO, East Helena pamphlet

tests were planned but EPA Method 5 procedures were not followed. The opacity tests were conducted using EPA Method 9.

The test crew consisted of Stu Salot, CTL, and a two person crew from CTL and one person from PES. Martin Byrne, EPA, Region VIII and Charles Counts, ASARCO, observed the stack testing. The process operations were monitored by Michael Davenport, EPA Montana Office and Jim Sieverson, ASARCO. Opacity observations were conducted during the stack tests by Dick Montgomery, Ken Alkema, and Tom Harris all of EPA Montana Office.

1. Sinter Machine

The Dwight and Lloyd updraft sinter machine, built in 1967 and modified in 1977, is designed to process approximately 1,000 tons per day of new material.(1) Sinter is also recycled across the sinter machine to dilute the sulfur in the new materials.

The charge to the sinter machine is made up of measured amounts of silica, concentrate, residue, dust, rejects and coke. The sinter charge is conveyed to a hammermill which breaks down the lumps in the charge and thoroughly mixes it. The mixture is next conveyed to a nodulizing drum where water is added thus forming the charge into nodules averaging 3/8 inch diameter. The nodules are conveyed to a second drum where return sinter is mixed with the charge.

On September 21, 1979, the return sinter was 102 tons/hr and the new material was 32 ton/hr. The sulfur content of the new material was 11 percent and the return sinter sulfur content was 1.6 percent. The Lurgi acid plant produced 251 tons of 98 percent $H_2SO_4$ on September 21, 1979.

The Dwight and Lloyd sinter machine operates in conjunction with a double contact acid plant. Through an elaborate gas recirculation system, the sinter machine can provide a strong (3-3.5 percent) $SO_2$ gas for particulate removal and acid conversion. The strong $SO_2$ gases from the sintering process are vented to a Cottrell hot electrostatic precipitation (ESP), two open scrubbers, two packed scrubbers, a mist precipitator and a double contact Lurgi sulfuric acid plant. The weak $SO_2$ gas stream from the end of the sinter machine is vented to a ventilation baghouse. Figure 3 is a flow diagram of the strong and weak gas control systems.

The weak $SO_2$ gases from the sinter machine are vented to a baghouse for particulate collection and exhausted to a 420 foot stack. The baghouse was constructed in 1977 and contains acrylic bags with an air to cloth ratio of 1.8 acfm / ft2. The baghouse is a positive pressure shaker type baghouse and operates on a three hour cleaning cycle of the 8 sections.

(1) Letter from S. M. Lane to Harry Keltz, dated June 2, 1978.

On September 21, 1979, lead emission tests were conducted on the ventilation baghouse to the main stack. The flow rate to the baghouse was 186,000 acfm at a temperature of 175°F. The source test results show that the main stack was emitting 84 lb/day of lead at a sinter machine process rate of 32 tons/hr of concentrate material.

The strong gas stream was not tested for lead emissions because the sulfur dioxide removal system of a hot electrostatic precipitator, open scrubber, packed scrubber, wet precipitator, and sulfuric acid plant would remove any lead or dust emissions.

2. Zinc Fuming Furnace

The zinc fuming plant consists of a zinc fuming furnace and zinc holding furnace. The plant processes molten slag from the blast furnace. The slag is received in five ton cars and is charged into a 650 ton/day zinc fuming furnace along with pulverized coal. The zinc is vaporized from the slag by blowing air and powdered coal into the bottom of the furnace. The charging and blowing cycle requires about 165 minutes for a 50 ton charge. The zinc vapor is oxidized to form zinc oxide, a white powder. The fume is cooled through a series of U-tubes and is collected in a baghouse. Most of the collected dust is transferred to closed hopper cars for shipment to ASARCO, El Paso. The molten material from the fuming furnace is tapped into the holding furnace where matte and speiss are separated from the slag. The matte and speiss are shipped to ASARCO, Tacoma and the slag is transported in a slag car to the dump.

The zinc furnace is designed to process 650 tons per day of slag. During the test the zinc furnace operated at about 420 tons per day of slag and 82 tons per day of coal producing 65 tons per day of zinc fume.

The zinc fuming baghouse operates at 220°F and 233,000 acfm. The baghouse is a shaker type containing six sections of 120 bags each and has a cleaning cycle every two hours. Figure 4 is a flow diagram of the baghouse control system.

On September 22-23, 1979, lead emission tests were conducted on the zinc fuming stack. The source test results show that the zinc stack was emitting 20 lb/day of lead at a process rate of 22 ton/hr.

3. Blast Furnace and Dross Plant.(2)

The company has two blast furnaces. Both blast furnaces have a design

(2) The final EIS for ASARCO, East Helena, 1974.

rate of 1000 tons per day. Figure 2 shows a schematic of the blast furnace area.

The company operates only one furnace at any time. The life of a blast furnace is from two weeks to about six weeks and one furnace is always down for repair or maintenance.

One blast furnace is charged using a charge car which transports and dumps the mixture of sinter, coke, and by-products into the blast furnace. The blast furnace is a water cooled rectangular column in which the charge is smelted. The smelting occurs when oxygen enriched air is injected into the bottom of the ignited furnace. The blast air burns the coke, providing heat to melt the charge. It also provides an agent to reduce the lead oxide that was formed in the sinter process. As the molten lead flows through the charge it absorbs other metals including gold, copper, silver, antimony, bismuth, and tin. The molten lead matte and molten slag are tapped from the bottom of the furnace. The slag components are carefully regulated to provide a clean separation of the slag and the lead matte.

The molten furnace lead is separated from the slag in a settler at the blast furnace. It is tapped from the settler into 10 ton uncovered pots and transferred to the dross plant where it is poured into 90 ton receiving kettles. Figure 6 shows a schematic of the dross plant.

The material is cooled and stirred causing the dross (iron, copper, and sulfides) to rise to the top of the kettle. The dross is skimmed off by means of a crane and a clamshell bucket, and is charged to a 130 ton/day reverberatory furnace. The remaining lead bullion containing gold, silver, and other impurities is poured into 10 ton molds and is shipped to ASARCO's Omaha, Nebraska plant.

The copper bearing dross is melted in a reverberatory furnace, and three products are tapped from the furnace at different levels determined by the materials' specific gravity. Matte and speiss (copper compounds) are tapped from the top two levels of the furnace and lead is tapped from the bottom. The matte and speiss are shipped to ASARCO's copper smelter in Tacoma, Washington and the lead is returned to the refining kettles for treatment before being shipped as bullion to the Omaha plant.

The particulates and lead emissions from the blast furnace and dross reverberatory furnace are controlled in three parallel baghouses and emitted to three 117 foot stacks. The baghouses were constructed in 1901. Each baghouse contains three sections of 360 dacron bags per section. The bags are cleaned every two hours by a mechanical shaker. The gas flow rate into the baghouses is about 300,000 acfm at a temperature of 162°F.

On September 26-29, 1979, the blast furnace number 1 was operated at 590 tons per day of sinter, coke and scrap iron. The blast furnace was in need of repairs and was scheduled for shut down on October 1, 1979. The

AT THE ASARCO, EAST HELENA Lead smelter during TSP+Pb tests on 9/20-29/79

0211842

AIR POLLUTANT EMISSION RATE, lb/day

| date tested | EMITTING FACILITY AND CONTROL DEVICE | process rate, ton/hr | TSP | $SO_2$ (3) | Pb | As | Cd. | OPACITY % | NOMENCLATURE |
|---|---|---|---|---|---|---|---|---|---|
| 9/21 | DWIGHT & LLOYD SINTER MACHINE<br>MAXIMUM DESIGN RATE 1000 tons/day of new material concentrate<br>BUILT in 1966 modified in 1977<br>Control: | 32.2 (1) | | | | | | | ER = Emission RATE<br>AR = ALLOWABLE RATE<br>CS = Compliance status<br>NR = No req.<br>NA = Not Available<br>IC = in compliance<br>OC = out of compliance |
| Not tested | A). Strong $SO_2$ gas HOT COTTRELL ESP open scrubber double contact Lurgi $H_2SO_4$ plant designed for 500 tons/day of 93% Acid Exhaust TO A 200 ft stack. built in 1977-1978 | 25 ton/day of 98% $H_2SO_4$ | NA | NA | NA | NA | NA | NA | |
| 9/21 | B). weak $SO_2$ gases cyclone To A baghouse with 1.9 Actm/ft² at 176°F 190,000 Actm exhausted To A 420 ft stack ACRYLIC bags dust returns to sinter machine. built in 1977 | ER = NA<br>AR = 40.6 (2) lb/hr<br>CS = NA % | ER = 19.3 ton/day<br>AR = 80 ton/day<br>CS = IC | ER = 8.4 ER = 92.6 ER = 1.6<br>AR = NR AR = NR AR = NR<br>CS = NR CS = NR CS = NR | | | | ER = 0.0<br>AR = 40<br>CS = I.C. | |

production rate of

(1) only new matl considered in the process. Recycled matl is 101.7 ton/hr. BASED ON April 22, 1972 letter from Robert Chass to H. Kelly

(2) Allowable rate at 32.2 ton/hr

(3) BASED ON 1978 Sulfur balance from P.A. DeSantis letter to H. Kelly dated 11/27/78

AT THE ASARCO, East Helena lead smelter during Pb+TSP tests on 9/20-29/79

AIR POLLUTANT Emission RATE, lb/day

0211843

| | date tested | EMITTING FACILITY AND CONTROL DEVICE | process rate, ton/hr (1) | TSP | $SO_2$ (2) | Pb | As | Cd. | OPACITY % | NOMENCLATURE |
|---|---|---|---|---|---|---|---|---|---|---|
| (2) | 9/22 | ZINC FUMING | | | | | | | | |
| | + | FURNACE | 21.8 | ER= [illegible] | ER= 8.3 tons/day | ER=19.8 | ER=10.4 | ER=0.5 | ER=0.0 | ER= EMISSION RATE |
| | 9/23 | (165 min cycle/batch) | | AR=32.3 lb/hr | AR=12 tons/day | AR= N.R. | AR= N.R. | AR=N.R. | AR=90 | AR= ALLOWABLE RATE |
| | | MAXIMUM DESIGN RATE: | | CS= N.? | CS= I.C. | CS= N.R. | CS= N.R. | CS=N.R. | CS= I.C. | CS= COMPLIANCE STATUS |
| | | | | | | | | | | NR= NO REGULATIONS |
| | | 450 tons/day of | | | | | | | | NA= NOT AVAILABLE |
| | | SLAG with 165 min cycles | | | | | | | | IC= IN COMPLIANCE |
| | | built in 1927 | | | | | | | | OC= OUT OF COMPLIANCE |
| | | Control: | | | | | | | | |
| | | ZINC fuming baghouse | | | | | | | | |
| | | operates at approximately | | | | | | | | |
| | | 220°F at 230,000 ACFM | | | | | | | | |
| | | emission exhausted to | | | | | | | | |
| | | a 250 foot stack. | | | | | | | | |
| | | built in 1973 | | | | | | | | |
| | | hoods on charging + | | | | | | | | |
| | | tapping meas. | | | | | | | | |
| | | | | | | | | | | |
| | | ZNO to ASARCO EL PASO | | | | | | | | |
| | | And Am. Chemet. | | | | | | | | |
| | | matte and speiss to ASARCO | | | | | | | | |
| | | TACOMA | | | | | | | | |
| | | production rate of 2.8 tons/hr of ZINC fume | | | | | | | | |
| | (1) | included coal, coke, cold slag | | | | | | | | |
| | | Avg. for 9/23 + 9/24 | | | | | | | | |
| | (2) | based on 1978 sulfur | | | | | | | | |
| | | balance. And slag treatment | | | | | | | | |
| | | $SO_2$ rule. | | | | | | | | |

AT THE ASARCO, East Helena lead smelter during Pb and TSP tests on 9/20-29/79.

AIR POLLUTANT EMISSION RATE, lb/Hr

0211844

| | date tested | EMITTING FACILITY AND CONTROL DEVICE | 1 PROCESS RATE, T/Hr | 2 TSP | | SO2 (2) | | Pb | As | Cd | | OPACITY % | | NOMENCLATURE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (3) | 9/26 | NO. 1 BLAST FURNACE | 31.8 | ER = | | ER = 5.2 | | ER = 58.6 | ER = 10.6 | ER = 16.7 | | ER = 0.0 | | ER = EMISSION RATE |
| 2 | thru | AND THE DROSS | | AR = 40.3 | | AR = 12 | | AR = NR | AR = NR | AR = NR | | AR = 40 | | AR = ALLOWABLE RATE |
| 3 | 9/29 | REVERBERATORY | | CS = | | CS = IC. | | CS = NR | CS = NR | CS = NR | | CS = | | CS = COMPLIANCE STATUS |
| 4 | | FURNACE | | | | | | | | | | | | NR = NO REGULATION |
| 5 | | | | | | | | | | | | | | NA = NOT AVAILABLE |
| 6 | | MAXIMUM DESIGN RATE: | | | | | | | | | | | | IC = IN COMPLIANCE |
| 7 | | BLAST FURNACES 1100 TONS | | | | | | | | | | | | OC = OUT OF COMPLIANCE |
| 8 | | No. 1 of lime, coke, sinter / day | | | | | | | | | | | | |
| 9 | | DROSS FURNACE: 130 TON/day | | | | | | | | | | | | |
| 10 | | BLAST FURNACE built in 1919, DROSS PLANT in 1945 | | | | | | | | | | | | |
| 11 | | Control device: | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | |
| 13 | | 3 parallel baghouses. | | | | | | | | | | | | |
| 14 | | each contain 1180 bags/18" dia x 30' | | | | | | | | | | | | |
| 15 | | collects for 326900 acfm total. | | | | | | | | | | | | |
| 16 | | 160°F gases exhaust to 3 | | | | | | | | | | | | |
| 17 | | 117 foot stacks | | | | | | | | | | | | |
| 18 | | bags are polyester | | | | | | | | | | | | |
| 19 | | built in 1901 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | |
| 25 | (1) | Avg for 4 days of test in | | | | | | | | | | | | |
| 26 | | process wt includes total | | | | | | | | | | | | |
| 27 | | 68 tons skips charge and lime in lbs | | | | | | | | | | | | |
| 28 | | 204 lbs coke, scrap, and sinter in lbs/t. | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | |
| 30 | (2) | BASED ON 1978 SULFUR BALANCE | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | |

AT THE ASARCO, East Helena lead smelter during Pb and TSP tests on 9/20-29/74 0211845

AIR POLLUTANT EMISSION RATE, lb/day

| | date tested | EMITTING FACILITY AND CONTROL DEVICE | process rate, ton/hr | TSP (1) | $SO_2$ (2) | Pb (1) | As (1) | Cd (1) | OPACITY | NOMENCLATURE |
|---|---|---|---|---|---|---|---|---|---|---|
| (4a) | | FUGITIVE DUST EMISSIONS | | | | | | | | ER = EMISSION RATE<br>AR = ALLOWABLE RATE<br>CS = COMPLIANCE STATUS<br>NR = NO REGULATION<br>NA = Not Available<br>IC = IN COMPLIANCE<br>OC = OUT OF COMPLIANCE |
| (4a) | 7/22/74 to 7/24/74 | SINTER BUILDING | | 64.8 | | 6.25 | 0.51 | NA | | |
| (4b) | 7/27/74 + 7/28/74 | BLAST FURNACE BUILDING | | 34.9 | | 3.78 | 0.55 | NA | | |
| (4c) | 7/27-7/29/74 + 7/28/74 | DROSS REVERBERATORY FURNACE BUILDING | | 300 | | 66.7 | 30.3 | NA | | |
| (4d) | 7/26/74 + 7/27/74 | ZINC FUMING BUILDING | | 33.6 | | 3.21 | 0.11 | NA | | |
| (4e) | | ORE-STORAGE BIN AREA. | | NA | | NA | NA | NA | | |

(1) based on data from EPA 450/3-77-033 Sample Fugitive lead emissions from 2 PRIMARY lead smelters.

0211846

AT THE

AIR POLLUTANT EMISSION RATE, lb/day

| | data tested | EMITTING FACILITY AND CONTROL DEVICE | process rate, ton/hr | TSP | $SO_2$ | Pb | As | Cd. | OPACITY | NOMENCLATURE |
|---|---|---|---|---|---|---|---|---|---|---|
| (5) | | TOTAL EMISSION | | | NA | 244 | 146 | NA | NA | ER = EMISSION RATE<br>AR = ALLOWABLE RATE<br>CS = COMPLIANCE STATUS<br>NR = NO REGULATION<br>NA = NOT AVAILABLE<br>IC = IN COMPLIANCE<br>OC = OUT OF COMPLIANCE |
| (5a) | | SOURCE EMISSIONS | | | 325 tons/day | 163 | 114 | 19 | NA | |
| (5b) | | FUGUTIVE EMISSION | | 447 | NA | 81 (1) | 31 | NA | NA | |

1 (1) does not include ore-Storage bin fugitive dust emissions

# ZINC DEPARTMENT FLOWSHEET

MARCH 1976